UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

8/26/99

MEMORANDUM

SUBJECT: **Terbufos**. List A Reregistration Case No. 0109/Chemical ID No. 105001. Revised Acute and Chronic Dietary Exposure Analyses for the HED Revised Risk Assessment. No MRID #. DP Barcode No. D258668.

FROM: Christina Swartz, Chemist
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THRU: David J. Miller
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and

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TO: William J. Hazel, Ph.D.
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and

Pamela Noyes/Jackie McQueen (PM 60)
Special Review Branch
Special Review and Reregistration Division (7508W)

Background/Action Requested

Acute probabilistic and chronic dietary exposure assessments were previously completed in conjunction with the HED preliminary risk assessment for the organophosphate active ingredient terbufos [C. Swartz memoranda dated 1/20/99 and 2/18/99 (Barcode Nos. D249385, 250807 and 253373)]. Chronic dietary exposure and risk were below HED's level of concern (all population subgroups); acute dietary exposure and risk were above HED's level of concern for certain population subgroups including infants and children. The estimated exposure to the general US

population consumed approximately 68 % of the acute Population Adjusted Dose (aPAD), while estimated exposure for non-nursing infants (<1 year) was approximately 260 % aPAD [risk reported at the 99.9th percentile of exposure].

Revised acute probabilistic and chronic dietary exposure estimates are required since the HED FQPA Safety Factor Committee (SFC) removed (reduced to 1X) the additional 3X safety factor retained for data gaps in accordance with the Food Quality Protection Act (FQPA, 1996). Current HED policy allows for use of the weighted average of percent crop treated (%CT), rather than the estimated maximum, in chronic dietary exposure assessments; therefore, a revised chronic dietary exposure and risk analysis should be prepared to reflect this change.

Conclusions

The terbufos dietary exposure analyses are based largely on residues below the limit of detection (LOD), between the LOD and the limit of quantitation (LOQ), or at or just above the LOQ. Available monitoring data did not include all terbufos residues of concern, but qualitatively support the results of the dietary exposure analyses conducted using field trial data.

Estimated chronic dietary exposure and risk for terbufos are significantly below HED's level of concern. The most highly exposed population subgroup is non-nursing infants, with an estimated exposure corresponding to 9 % of the chronic Population Adjusted Dose (cPAD). Estimated dietary exposure to the general US population is lower, corresponding to 2 %cPAD.

In the acute dietary exposure assessment, risk at the 99.9th percentile of exposure is reported since the analysis was refined using residue distribution files and %CT data. Estimated acute dietary exposure and risk are below HED's level of concern for terbufos. At the 99.9th percentile of exposure, the most highly exposed population subgroup is non-nursing infants, with 86 % of the acute Population Adjusted Dose (aPAD) consumed. Estimated dietary exposure to the general US population is much lower, corresponding to 23 %aPAD.

Additional analyses conducted to further characterize terbufos acute dietary risk indicate that bananas are the most significant contributor to estimated risk. When bananas are excluded from the analysis, the most highly exposed population subgroup is children 1-6 years, with an exposure corresponding to 12 %aPAD.

The chronic and acute analyses do not take into consideration the potential for reduction or concentration of terbufos residues in cooked/canned/processed bananas and sweet corn, since there are no chemical-specific cooking studies. HED will refine the terbufos dietary exposure analyses if such data become available.

DETAILED CONSIDERATIONS

Toxicology Information

Endpoints and doses for terbufos risk assessments have been selected by the HED Hazard Identification Assessment Review Committee (HIARC) in meetings held 9/25/97 (J. Rowland), 9/23/98 (E. Mendez/B. Tarplee), 12/8/98 (W. Phang/B. Tarplee), 1/12/99 (P. Wagner/M. Ioannou), 2/17/99 (P. Wagner/M. Ioannou) and 8/2/99 (B. Tarplee). In addition, endpoints for risk assessment were discussed in the 7/7/98 "Hazard Assessment of the Organophosphates." The current doses and endpoints for terbufos dietary risk assessments are shown in Table 1. Refer to the referenced memoranda for details.

The potential for increased susceptibility of infants and children to terbufos was discussed in the 9/25/97 HIARC memo. The application of an additional safety factor required under FQPA was discussed in the 8/6/98 "FQPA Safety Factor Recommendations for the Organophosphates," and in the 8/6/99 HED FQPA SFC report for terbufos (B. Tarplee). The 8/6/99 report supersedes the 1998 document. Based on both hazard and exposure data, the HED FQPA SFC recommended that the FQPA Safety Factor be removed (reduced to 1X) in assessing risks resulting from the use of terbufos.

Table 1. Summary of Doses/Endpoints for Dietary Risk Assessment for Terbufos.

EXPOSURE SCENARIO	DOSE(mg/kg/day) [Uncertainty Factors][1]	ENDPOINT[2]	STUDY	RfD/PAD[3] (mg/kg/day)
Acute dietary	0.15 (NOAEL) Conventional UF = 100X Interspecies Sensitivity Factor = 5X FQPA = 1X	Plasma ChEI	Acute Neurotoxicity, Rat [Interspecies Sensitivity Factor Derived from a 28-Day Oral Toxicity Study in Dogs]	Acute RfD = 0.0003 Acute PAD = 0.0003 (aPAD)
Chronic dietary	0.005 (NOAEL) Conventional UF = 100X FQPA = 1X	Plasma ChEI	28-Day Oral Toxicity, Dog [Supported by 6-month and 1-year studies]	Chronic RfD = 0.00005 Chronic PAD = 0.00005 (cPAD)

[1] The conventional uncertainty factor of 100X consists of 10X for interspecies extrapolation and 10X for intra-species variability. For the acute dietary exposure assessment, an additional 5X interspecies sensitivity factor was applied to account for differences in rat and dog sensitivity (refer to the 2/17/99 HIARC memo).

[2] ChEI = Cholinesterase inhibition.

[3] RfD = Reference Dose = NOAEL/UF; PAD = Population Adjusted Dose = RfD/FQPA Safety Factor.

Usage Information

An updated quantitative usage analysis (QUA) was provided by OPP/BEAD (D. Herzi, 7/99, Attachment 1). Estimated usage was presented in terms of both weighted average and estimated maximum % crop treated (%CT) for field corn, sweet corn, sugar beets and sorghum; average application rates/number of applications were also provided. The updated usage estimates shown in attachment 1 were used in the revised chronic (weighted average of %CT) and acute (estimated maximum of %CT) analyses. In previous memoranda, Agency %CT estimates were similar to those provided by the registrant, American Cyanamid (AMCY).

BEAD/OPP estimated 26% of bananas for import are treated with terbufos, which is similar to the AMCY estimate of 27 %CT. BEAD further stated that if imported bananas are treated in the same proportion as all bananas in the exporting countries, about 26% of US banana imports would be treated. If treated bananas were always sent to the US when available, as much as 57% of US banana imports could be treated; if untreated bananas were always sent to the US when available, then approximately 6% of US banana imports would be treated. In the previous and current dietary exposure analyses, HED used the 27 %CT estimate for both acute and chronic assessments.

The registrant's estimate of 0.3 %CT for coffee was rounded to 1% for current and previous assessments. A time-limited tolerance for residues in coffee expired, but the registrant may want to support continued use on coffee.

HED incorporates adjustments for weighted average %CT into chronic analyses using Adjustment Factor 2 in the DEEM™ software. In acute analyses, HED considers commodities to be either non-blended (e.g., bananas), partially blended (e.g., grapes, berries, and canned food forms of some non-blended commodities), or blended (e.g., sugars, grains and oil). When field trial residue data serve as the basis for the acute assessment for non-blended and partially blended commodities, the adjustment for estimated maximum %CT is incorporated in the residue distribution files (RDFs) via addition of zero residue values corresponding to the % crop not treated. For commodities considered to be blended, the adjustment for %CT is incorporated into the acute anticipated residue (AR) point estimate.

Processing Factors

The DEEM™ software HED uses to conduct dietary exposure analyses contains default processing factors (PFs) based on moisture loss and volume changes during processing. In the absence of data on the potential for concentration or reduction during processing, HED policy is to use the default PFs. In the current analysis, default factors were 3.9 for dried bananas/plantains, and 1.5 for high fructose corn syrup and molasses.

HED does not have data to demonstrate the affect of heating/boiling/canning on terbufos residues

in canned banana and sweet corn commodities. Therefore, the current analysis does not take into account the potential for reduction (or concentration) of terbufos residues in these commodities.

Based on a sugar beet processing study conducted for the active ingredient phorate, which is structurally similar to terbufos, HED has excluded sugar beet commodities from the current and previous dietary exposure analyses. The study demonstrated that the liming and carbonation processes that typically occur during beet sugar manufacture degrade phorate (and, by translation, terbufos) residues.

Residue Data

Existing and reassessed tolerances are established for the combined residues of terbufos and its cholinesterase-inhibiting metabolites in or on plant commodities [40 CFR §180.352(a)]. The phosphorylated (cholinesterase-inhibiting) metabolites include terbufos oxygen analog (oxon); terbufos sulfoxide; terbufos sulfone; terbufos oxygen analog sulfoxide; and terbufos oxygen analog sulfone. Adequate data collection and enforcement methods are available to detect terbufos residues in plant commodities. No food/feed additive, meat, milk, poultry, or egg tolerances have been established for terbufos. Tolerances are not required for residues in livestock commodities, since HED has concluded there is no reasonable expectation of detectable residues [40 CFR §180.6(a)3].

No new residue data have been generated for the current analyses. The registrant submitted a sensitivity analysis [AMCY submission dated 5/21/99 (MRID No. 44834301)], which discusses hazard inputs to the analysis, USDA consumption data, and all available residue data for relevant commodities. The registrant proposes HED consider removing 4 banana field trial residues from terbufos dietary exposure analyses. The submission is currently under review. For the current analyses, there are no changes in the residue inputs from field trial data.

The chronic anticipated residues used in previous analyses have been used in the current analysis along with the weighted average %CT estimates (rather than the estimated maximum %CT). In previous HED acute dietary exposure analyses, banana and sweet corn RDFs submitted by AMCY were used. HED policies for conducting acute probabilistic analyses have been modified since the 2/99 terbufos dietary exposure analysis (memo, M. Stasikowski, 8/20/99); however, the changes do not affect the terbufos residue inputs, which were derived from field trials. Therefore, residue inputs from the previous analyses have been used in the current analyses, with minor changes to reflect the new estimated maximum %CT estimates. Relevant data are discussed in detail below, and the associated residue inputs to the DEEM™ analyses are summarized in Table 2. In addition, RDFs used in the current acute analysis are shown in detail in Attachment 2.

Banana

Banana field trial data summarized in the 12/23/98 C. Swartz memo (DP Barcode No. D249392) were incorporated into RDFs in both the AMCY and HED acute probabilistic analyses. A total of

54 data points ranging from less than the limit of detection (LOD, 0.0002 ppm for the newer analytical method) to a maximum of 0.016 ppm were used. Most of the samples had either non-detectable residues or residues between the LOD and the limit of quantitation (LOQ).

The registrant provided proprietary information pertaining to the percentage of banana acreage treated at a lower rate of 3 g ai/mat (27%) vs. the percentage treated at the higher rate of 4 g ai/mat (0.3%); this information was incorporated into the residue distribution file via weighting of field trial data corresponding to the lower application rate. A total of 14 data points were available from the 3 g ai/mat application rate, while 40 data points were available from studies in which the 4 g ai/mat application rate was used. The weighting was accomplished by counting each residue from the 3 g ai/mat rate 250 times, counting each residue from the 4 g ai/mat one time, and adding in a total of 9,231 zeros. HED notes that the weighting of the 3 g ai/mat data was originally proposed by the registrant and results in a more conservative estimate of dietary exposure and risk. In the registrant's submitted sensitivity analysis and rebuttal to the HED risk assessment, an analysis in which the field trial data from both 1X rates were weighted equally resulted in a lower estimate of dietary exposure and risk.

The same residue data were used in the chronic dietary risk analysis; the weighted average residue of 0.007 ppm was used, and the adjustment for 27 %CT was applied via Adjustment Factor 2.

When dietary exposure analyses include bananas, plantains are also included since cultural practices for the two commodities are generally similar.

Corn (Field and Pop)

The commodities associated with terbufos use on field (and pop) corn are considered to be blended in HED dietary exposure analyses, and an average of available 1X residue data was used for both the acute and chronic dietary exposure assessments. In the chronic assessment, the average field corn residue of 0.003 ppm was used, and the adjustment for weighted average %CT (8%) was made via application of Adjustment Factor 2 in the DEEM™ analysis. For the acute assessment, the estimated maximum %CT (10%) was incorporated into the average residue, to yield a residue of 0.0003 ppm (no further adjustment made via Adjustment Factor 2).

These residues were also used for relevant processed commodities of field corn, such as bran and endosperm.

Sweet Corn

Residue data submitted in 1972-1974 were used in the analysis. Although numerous field trials were conducted, only 14 data points are available at rates ranging from 1 to 1.3 lb ai/A, the maximum 1X rate. Out of 14 data points, 13 were non-detects, (reported as ½ LOD), while one sample contained residues between the LOD and the LOQ. The average (anticipated) residue in sweet corn (0.006 ppm) was used in the chronic analysis, with a weighted average %CT of 5%

applied via Adjustment Factor 2.

The sweet corn RDF used in previous acute analyses included 14 data points and 167 zeros to account for 8 %CT. In the current analysis, the RDF was modified to include 233 zeros, since the revised QUA indicates an estimated maximum of 6 %CT (See Table 2 and Attachment 2).

Sugar Beet

Terbufos use on sugar beets is supported by adequate residue data; sugarbeet commodities included in DEEM™ are sugar and molasses. As stated above, these commodities were excluded from both chronic and acute analyses since residues are believed to degrade during processing.

Sorghum

No consumption was reported for sorghum in the 1989-1992 USDA CSFII. Previous HED and AMCY exposure assessments excluded sorghum from acute and chronic analyses. Sorghum is not considered to be a significant source of exposure given its minimal consumption, extensive processing, and low residue values (field trial data were all non-detects, with an LOQ of 0.05 ppm). Sorghum has been excluded from the current analyses.

Coffee

Use on coffee may be supported through reregistration, so coffee was included in both acute and chronic analyses. A total of 8 data points were available, following applications ranging from 0.75 to 1.5 g ai/plant, with a maximum 1X rate of 1 g ai/plant. Residues were detected in only 1 of 8 samples, at the LOQ of 0.05 ppm; the other 7 residues were <0.05 ppm, and were incorporated into the assessment at ½ LOQ. Coffee is considered to be a blended commodity (HED ChemSAC, 8/20/99), and therefore an average (anticipated) residue was used in both the chronic and acute analyses. The average residue of 0.028 ppm was used in the chronic analysis, with Adjustment Factor 2 applied to account for 1 %CT. In the acute analysis, the %CT estimate was applied to the average residue, to yield a residue input of 0.00028 ppm (no additional adjustment made with Factor 2).

Table 2. Terbufos Residue Inputs to the Acute and Chronic Dietary Exposure Analyses.

Commodity	% Crop Treated		Average Residue (ppm)	Acute Residue Input: RDF or AR (ppm)[1]	Chronic Residue Input (ppm)[2]	Adjustment Factor 2 (Chronic Only)[3]
	Wtd. Ave.	Est. Max.				
Banana/Plantain	27[4]		0.007	3,540NZ, 9,231Z	0.007	0.27
Field/Pop Corn	8	10	0.003	0.0003	0.003	0.08
Sweet Corn	5	6	0.006	14 NZ, 266Z	0.006	0.05
Coffee	1[5]		0.028	0.00028	0.028	0.01

[1] Residue distribution files (RDFs) were used for commodities considered to be non-blended, while point estimates were entered for blended commodities. The blended point estimate consisted of the average residue multiplied by the estimated maximum %CT (no further adjustment made using Adjustment Factor 2 in the DEEM™ analysis.

For RDFs, the number of residue values (non-zeros) is designated "NZ," and the number of zeros added to account for the % of crop not treated is designated "Z."

[2] The average residue from field trial data was entered in the DEEM™ analysis.

[3] The adjustment for weighted average %CT was made by entering the weighted average %CT (as a percentage) as Adjustment Factor 2 in the DEEM™ analysis.

[4] BEAD usage data do not permit a reliable estimate of weighted average and estimated maximum %CT. The 27% value reflects the assumption that imported bananas are treated in the same proportion as all bananas in the exporting countries.

[5] The registrant (AMCY) provided the Agency with an estimate of 0.3 %CT (rounded to 1%CT) for coffee. BEAD/OPP did not provide usage estimates for coffee, so HED used the 1%CT estimate in both acute and chronic assessments.

Consumption Data

HED conducts dietary risk assessments using the Dietary Exposure Evaluation Model (DEEM™), which incorporates consumption data generated in USDA's Continuing Surveys of Food Intakes by Individuals (CSFII), 1989-1992. For chronic dietary risk assessments, the three-day average of consumption for each sub-population is combined with residues in commodities to determine average exposure in mg/kg/day. For refined acute dietary risk assessments, the entire distribution of consumption events for individuals is multiplied by a distribution of residues (probabilistic analysis, referred to as "Monte Carlo," risk at 99.9th percentile of exposure reported) to obtain a distribution of exposures in mg/kg/day.

Results

Detailed results of the chronic and acute dietary exposure and risk analyses are shown in Table 3.

Chronic

HED's level of concern for terbufos chronic dietary exposure is 100% of the chronic Population Adjusted Dose (cPAD), or 0.00005 mg/kg/day. Estimated chronic dietary exposure and risk for terbufos are significantly below HED's level of concern. The most highly exposed population subgroup is non-nursing infants, with an estimated exposure corresponding to 9% cPAD. Estimated dietary exposure to the general US population is lower, corresponding to 2 %cPAD.

Acute

HED's level of concern for terbufos acute dietary exposure is 100% of the acute Population Adjusted Dose (aPAD), or 0.0003 mg/kg/day. Risk at the 99.9th percentile of exposure is reported, since the acute assessment was refined using residues distribution files and %CT data. Estimated acute dietary exposure and risk are below HED's level of concern for terbufos. At the 99.9th percentile of exposure, the most highly exposed population subgroup is non-nursing infants, with 86 %aPAD consumed. Estimated dietary exposure to the general US population is much lower, corresponding to 23 %aPAD.

Additional analyses conducted to further characterize terbufos acute dietary risk indicate that bananas are a significant contributor to estimated risk. When bananas are excluded from the analysis, the most highly exposed population subgroup is children 1-6 years, with an exposure corresponding to 12 %aPAD.

Table 3. Terbufos Acute Probabilistic (Monte Carlo) and Chronic Dietary Exposure and Risk Estimates.[1]

Population Subgroup	Chronic Assessment		Acute Assessment 1 (99.9th %-ile)		Acute Assessment 2 (99.9th %-ile)		Acute Assessment 3 (99.9th %-ile)		Acute Assessment 4 (99.9th %-ile)	
	Exposure mg/kg/day	%cPAD	Exposure mg/kg/day	%aPAD	Exposure mg/kg/day	%aPAD	Exposure mg/kg/day	%aPAD	Exposure mg/kg/day	%aPAD
General US Population	0.000001	2	0.000069	23	0.000017	6	0.000063	21	0.000070	23
All infants (<1 yr)	0.000004	7	0.000246	82	0.000006	2	0.0000254	84	0.000253	84
Nursing infants	0.000001	3	0.000129	43	0.000002	<1	0.000128	43	0.000125	42
Non-nursing infants	0.000005	9	0.000259	86	0.000006	2	0.000260	87	0.000260	87
Children 1-6 yrs	0.000002	5	0.000137	46	0.000039	13	0.000133	44	0.000141	47
Children 7-12 yrs	0.000001	3	0.000068	23	0.000026	9	0.000063	21	0.000069	23
Females 13-19	0.000001	1	0.000035	12	0.000012	4	0.000032	11	0.000036	12
Females 20+	0.000001	1	0.000036	12	0.000012	4	0.000034	11	0.000037	12
Females 13-50	0.000001	1	0.000036	12	0.000012	4	0.000033	11	0.000036	12
Males 13-19	0.000001	2	0.000046	16	0.000016	5	0.000041	14	0.000050	17
Males 20+	0.000001	1	0.000029	10	0.000012	4	0.000028	9	0.000032	11
Assessment Description	Includes All Commodities		Includes All Commodities		Excludes Bananas		Excludes Sweet Corn		Excludes Field Corn	

[1] The chronic Population Adjusted Dose (cPAD) is 0.00005 mg/kg/day. The acute Population Adjusted Dose (aPAD) is 0.0003 mg/kg/day.

Attachments:

Attachment 1. Revised Quantitative Usage Analysis (D. Herzi, BEAD/OPP, 7/99).
Attachment 2: Residue Distribution Files for Banana and Sweet Corn.
Attachment 3: Terbufos Chronic Dietary Exposure and Risk Analysis.
Attachment 4: Terbufos Acute Probabilistic Dietary Exposure and Risk Analysis.
Attachment 5: Terbufos Acute Probabilistic Dietary Exposure and Risk Analysis, Excluding Bananas.
Attachment 6: Terbufos Acute Probabilistic Dietary Exposure and Risk Analysis, Excluding Sweet Corn.
Attachment 7: Terbufos Acute Probabilistic Dietary Exposure and Risk Analysis, Excluding Field Corn.

cc: Reviewer, C. Swartz; List A File, DRES Files (LaShonia Richardson, HED/7509C)
CSwartz:RRB1:CM2:Rm 722H:703 305 5877:8/19/99
Secondary Review: David J. Miller:08/24/99
Dietary Exposure SAC Review: 08/24/99

Attachment 1: BEAD/OPP Revised Quantitative Usage Analysis (7/99).

Terbufos **Case#: 0109 AI#: 105001** **Quantitative Usage Analysis** **Analyst: Dhol Herzi** **July 1999**

Site	Acres Grown (000)	Acres Treated (000)		% of Crop Treated		LB AI Applied (000)		Average Application Rate			States of Most Usage
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl	(% of total lb ai used on this site)
Sweet Corn	784	40	50	5%	6%	55	83	1.366	1.0	1.3393	FL WI MN IL PA ID 63%
Sorghum	11280	249	413	2%	4%	190	344	0.763	1.0	0.7288	TX KS NM 81%
Corn	71264	5700	7000	8%	10%	6530	8980	1.146	1.1	1.0804	IA NE IL IN WI CO 67%
Sugar Beets	1415	500	610	35%	43%	670	890	1.34	1.0	1.3154	MN ND ID WY 87%

COLUMN HEADINGS

Wtd Avg = Weighted average--the most recent years and more reliable data are weighted more heavily.
Est Max = Estimated maximum, which is estimated from available data.
Average application rates are calculated from the weighted averages.

NOTES ON TABLE DATA

Usage data primarily covers 1987 - 1996. Calculations of the above numbers may not appear to agree because they are displayed as rounded
to the nearest 1000 for acres treated or lb. a.i. (Therefore 0 = < 500)
to the nearest whole percentage point for % of crop treated. (Therefore 0% = < 0.5%)

0* = Available EPA sources indicate that no usage is observed in the reported data for this site, which implies that there is little or no usage.
A dash (-) indicates that information on this site is NOT available in EPA sources or is insufficient.

*** Other/Crop Groups**

Bulb Crops include garlic, leeks, and onions.

Attachment 1: BEAD/OPP Revised Quantitative Usage Analysis (7/99).

Cole Crops includes broccoli, Brussels sprouts, cabbage, cauliflower, mustard greens, collards, bok choy, and chard.
Cucurbits includes cucumber, squash, and pumpkin.
Melons include cantaloupe, watermelon, honeydew, muskmelon, and winter melon.
Root and Tuber Crops include red beets, carrots, horseradish, parsnips, radish, rutabagas, sweet potatoes, turnips, and yams.
Vegetables, Other includes, artichokes, asparagus, okra, oriental vegetables, rhubarb, and truck garden.
Other Crops include ornamentals, popcorn, rapeseed/canola, and safflower.

SOURCES: EPA data, USDA, and National Center for Food and Agricultural Policy

Attachment 2. Residue Distribution Files for Banana and Sweet Corn.

Bananas

Nonnormalized field trials - bananas (half lod/loq)
adj for 3 g ai and 4 g ai rates
TOTALZ=9231

250,0.016	1,0.00022	1,0.00023
250,0.01	1,0.00028	1,0.00024
250,0.005	1,0.0002	1,0.00062
250,0.005	1,0.0001	1,0.0008
250,0.015	1,0.0001	1,0.00061
250,0.005	1,0.0001	1,0.00051
250,0.005	1,0.00041	1,0.0001
250,0.005	1,0.00044	1,0.0001
250,0.005	1,0.00034	1,0.0001
250,0.005	1,0.00052	1,0.0001
250,0.005	1,0.00024	1,0.0001
250,0.005	1,0.00023	1,0.0001
250,0.005	1,0.00019	1,0.0002
250,0.005	1,0.00022	1,0.0001
1,0.005	1,0.0001	1,0.00047
1,0.005	1,0.00022	1,0.00041
1,0.005	1,0.0001	1,0.00039
1,0.011	1,0.0001	1,0.00037

Sweet Corn

CORN, SWEET 6% CT (LODs 1X applic only)
TOTALZ=266
TOTALNZ=14

0.0045	0.005	0.0025
0.005	0.01	0.002
0.005	0.005	0.0025
0.004	0.025	0.0025
0.0035	0.0025	

Attachment 3: Terbufos Chronic Dietary Exposure and Risk Analysis.

U.S. Environmental Protection Agency Ver. 6.76
DEEM Chronic analysis for TERBUFOS 1989-92 data
Residue file: C:\DRESSAC\105001r.R96 Adjust. #2 used
Analysis Date 08-18-1999 Residue file dated: 08-18-1999/12:50:14/8
Reference dose (RfD) = 0.00005 mg/kg bw/day
Comment:UFs include 10X, 10X, 5X (acute only), and 1X for FQPA. Includes revised %CT data and new tox data.

Food Code	Crop Grp	Food Name	RESIDUE (ppm)	Adj.Factors #1	#2
72	O	Bananas	0.007000	1.000	0.270
73	O	Bananas-dried	0.007000	3.900	0.270
94	O	Plantains-ripe	0.007000	1.000	0.270
112	O	Coffee	0.028000	1.000	0.010
237	15	Corn/pop	0.003000	1.000	0.080
238	15	Corn/sweet	0.006000	1.000	0.050
266	15	Corn grain-endosperm	0.003000	1.000	0.080
267	15	Corn grain-bran	0.003000	1.000	0.080
268	15	Corn grain/sugar/hfcs	0.003000	1.500	0.080
289	15	Corn grain-oil	0.003000	1.000	0.080
378	O	Bananas-juice	0.007000	1.000	0.270
388	15	Corn grain/sugar-molasses	0.003000	1.500	0.080
481	O	Plantains-dried	0.007000	3.900	0.270

Attachment 3: Terbufos Chronic Dietary Exposure and Risk Analysis.

U.S. Environmental Protection Agency Ver. 6.76
DEEM Chronic analysis for TERBUFOS (1989-92 data)
Residue file name: C:\DRESSAC\105001r.R96 Adjustment factor #2 used.
Analysis Date 08-18-1999/12:50:54 Residue file dated: 08-18-1999/12:50:14/8
Reference dose (RfD, CHRONIC) = .00005 mg/kg bw/day
COMMENT 1: UFs include 10X, 10X, 5X (acute only), and 1X for FQPA. Includes revised %CT data and new tox data.

Total exposure by population subgroup

Population Subgroup	Total Exposure mg/kg body wt/day	Total Exposure Percent of Rfd
U.S. Population (total)	0.000001	1.9%
U.S. Population (spring season)	0.000001	1.9%
U.S. Population (summer season)	0.000001	1.8%
U.S. Population (autumn season)	0.000001	1.8%
U.S. Population (winter season)	0.000001	2.1%
Northeast region	0.000001	1.8%
Midwest region	0.000001	1.8%
Southern region	0.000001	2.0%
Western region	0.000001	1.9%
Hispanics	0.000001	2.1%
Non-hispanic whites	0.000001	1.9%
Non-hispanic blacks	0.000001	1.7%
Non-hisp/non-white/non-black)	0.000001	2.4%
All infants (< 1 year)	0.000004	7.2%
Nursing infants	0.000001	3.0%
Non-nursing infants	0.000005	9.0%
Children 1-6 yrs	0.000002	4.9%
Children 7-12 yrs	0.000001	2.6%
Females 13-19(not preg or nursing)	0.000001	1.3%
Females 20+ (not preg or nursing)	0.000001	1.4%
Females 13-50 yrs	0.000001	1.2%
Females 13+ (preg/not nursing)	0.000001	1.5%
Females 13+ (nursing)	0.000001	1.8%
Males 13-19 yrs	0.000001	1.8%
Males 20+ yrs	0.000001	1.3%
Seniors 55+	0.000001	1.7%
Pacific Region	0.000001	1.8%

Attachment 4: Terbufos Acute Probabilistic Dietary Exposure and Risk Analysis.

```
U.S. Environmental Protection Agency                                    Ver. 6.78
DEEM Acute analysis for TERBUFOS                                      1989-92 data
Residue file name: C:\DRESSAC\105001c.R96                  Adjust. #2 NOT used
Analysis Date 08-20-1999            Residue file dated: 08-18-1999/12:47:13/8
Reference dose: aRfD = 0.0003 mg/kg bw/day  NOEL = 0.15 mg/kg bw/day
Comment: UFs include 10X, 10X, 5X (acute only), and 1X for FQPA. Includes revised %CT data,
new TOX data, All commodities
-------------------------------------------------------------------------------
RDF indices and file names for Monte Carlo Analysis
 1  C:\DRESSAC\Nnftban.rdf
 2  C:\DRESSAC\Swtcorn.rdf
```

Food	Crop Grp	Food Name	RESIDUE (ppm)	RDF #	Adj.Factors #1	Adj.Factors #2	Code
72	O	Bananas	0.016000	1	1.000	1.000	
73	O	Bananas-dried	0.016000	1	3.900	1.000	
94	O	Plantains-ripe	0.016000	1	1.000	1.000	
112	O	Coffee	0.000280	0	1.000	1.000	
237	15	Corn/pop	0.000240	0	1.000	1.000	
238	15	Corn/sweet	0.025000	2	1.000	1.000	
266	15	Corn grain-endosperm	0.000240	0	1.000	1.000	
267	15	Corn grain-bran	0.000240	0	1.000	1.000	
268	15	Corn grain/sugar/hfcs	0.000240	0	1.500	1.000	
289	15	Corn grain-oil	0.000240	0	1.000	1.000	
378	O	Bananas-juice	0.016000	1	1.000	1.000	
388	15	Corn grain/sugar-molasses	0.000240	0	1.500	1.000	
481	O	Plantains-dried	0.016000	1	3.900	1.000	

Summary of Residue Distribution Files (RDF) listed in C:\DRESSAC\105001c.R96

RDF #	File Name	N residues w freq's	N residues w/o freq's	N LODs	LOD Value	N Zeros
1	Nnftban.rdf	54	0	0	0	9231
2	Swtcorn.rdf	0	14	0	0	233

Attachment 4: Terbufos Acute Probabilistic Dietary Exposure and Risk Analysis.

```
U.S. Environmental Protection Agency                                    Ver. 6.78
DEEM ACUTE analysis for TERBUFOS                                  (1989-92 data)
Residue file: 105001c.R96                          Adjustment factor #2 NOT used.
Analysis Date: 08-19-1999/16:42:01    Residue file dated: 08-18-1999/12:47:13/8
Acute Reference Dose (aRfD) =   0.000300 mg/kg body-wt/day
NOEL (Acute) =   0.150000 mg/kg body-wt/day
MC iterations = 1000     MC list in residue file     MC seed =  1026
Run Comment: UFs include 10X, 10X, 5X (acute only), and 1X for FQPA. Includes
revised %CT data, new TOX data, All commodities
================================================================================

Summary calculations:

      95th Percentile             99th Percentile             99.9th Percentile
 Exposure  % aRfD     MOE    Exposure  % aRfD     MOE    Exposure  % aRfD     MOE
---------- ------- -------- ---------- ------- -------- ---------- ------- --------
U.S. pop - all seasons:
  0.000002    0.68    74049   0.000018    5.94     8416   0.000069   22.94     2179
All infants (<1 year):
  0.000014    4.51    11085   0.000086   28.64     1745   0.000246   81.86      610
Nursing infants (<1 year):
  0.000001    0.33   151070   0.000043   14.47     3455   0.000129   42.87     1166
Non-nursing infants (<1 yr):
  0.000017    5.75     8690   0.000085   28.40     1760   0.000259   86.41      578
Children (1-6 years):
  0.000005    1.69    29548   0.000048   16.03     3118   0.000137   45.81     1091
Children (7-12 years):
  0.000002    0.64    78179   0.000022    7.47     6696   0.000068   22.73     2199
Females (13-19 yrs/np/nn):
  0.000001    0.32   154796   0.000011    3.57    14004   0.000035   11.76     4252
Females (20+ years/np/nn):
  0.000001    0.46   107694   0.000013    4.39    11397   0.000036   12.03     4157
Females (13-50 years):
  0.000001    0.31   162150   0.000012    3.89    12861   0.000036   11.88     4208
Males (13-19 years):
  0.000001    0.50   100069   0.000015    5.09     9825   0.000046   15.48     3230
Males (20+ years):
  0.000001    0.36   139389   0.000011    3.54    14143   0.000029    9.79     5109
```

Attachment 5: Terbufos Acute Probabilistic Dietary Exposure and Risk Analysis, Excluding Bananas.

```
U.S. Environmental Protection Agency                                    Ver. 6.78
DEEM Acute analysis for TERBUFOS                                      1989-92 data
Residue file name: C:\DRESSAC\105001m.R96                  Adjust. #2 NOT used
Analysis Date 08-20-1999            Residue file dated: 08-18-1999/12:30:48/8
Reference dose: aRfD = 0.0003 mg/kg bw/day  NOEL = 0.15 mg/kg bw/day
Comment: UFs include 10X, 10X, 5X (acute only), and 1X for FQPA.  Excludes Bananas
--------------------------------------------------------------------------------
RDF indices and file names for Monte Carlo Analysis
 1  C:\DRESSAC\Swtcorn.rdf
Food Crop                                    RESIDUE    RDF  Adj.FactorsCode
      Grp  Food Name                          (ppm)      #    #1     #2
---- ---- -------------------------------  ----------  --- ------ ------
 112 O    Coffee                            0.000280    0  1.000  1.000
 237 15   Corn/pop                          0.000240    0  1.000  1.000
 238 15   Corn/sweet                        0.025000    1  1.000  1.000
 266 15   Corn grain-endosperm              0.000240    0  1.000  1.000
 267 15   Corn grain-bran                   0.000240    0  1.000  1.000
 268 15   Corn grain/sugar/hfcs             0.000240    0  1.500  1.000
 289 15   Corn grain-oil                    0.000240    0  1.000  1.000
 388 15   Corn grain/sugar-molasses         0.000240    0  1.500  1.000

   Summary of Residue Distribution Files (RDF) listed in C:\DRESSAC\105001m.R96
 RDF      File        N residues   N residues   N LODs      LOD       N Zeros
  #       Name         w freq's    w/o freq's              Value
 ----  -----------   ----------   ----------   ------   ----------   -------
  1    Swtcorn.rdf       0          14           0        0             233

U.S. Environmental Protection Agency                                    Ver. 6.78
DEEM ACUTE analysis for TERBUFOS                                  (1989-92 data)
Residue file: 105001m.R96                       Adjustment factor #2 NOT used.
Analysis Date: 08-20-1999/10:01:45    Residue file dated: 08-18-1999/12:30:48/8
Acute Reference Dose (aRfD) =   0.000300 mg/kg body-wt/day
NOEL (Acute) =   0.150000 mg/kg body-wt/day
MC iterations = 1000     MC list in residue file     MC seed =  1026
Run Comment: UFs include 10X, 10X, 5X (acute only), and 1X for FQPA.  Excludes
 Bananas
================================================================================
Summary calculations:
      95th Percentile             99th Percentile             99.9th Percentile
 Exposure  % aRfD     MOE    Exposure  % aRfD     MOE    Exposure  % aRfD     MOE
---------- ------- -------- ---------- ------- -------- ---------- ------- --------
U.S. pop - all seasons:
  0.000001    0.34   147272   0.000002    0.73    68635   0.000017    5.64     8857
All infants (<1 year):
  0.000002    0.76    66050   0.000003    1.12    44807   0.000006    1.94    25813
Nursing infants (<1 year):
  0.000001    0.23   213107   0.000001    0.40   124787   0.000002    0.51    98438
Non-nursing infants (<1 yr):
  0.000002    0.79    63469   0.000004    1.19    41947   0.000006    2.12    23566
Children (1-6 years):
  0.000002    0.63    79372   0.000003    1.15    43423   0.000039   13.08     3824
Children (7-12 years):
  0.000001    0.46   108143   0.000003    0.83    59968   0.000026    8.63     5790
Females (13-19 yrs/np/nn):
  0.000001    0.28   177590   0.000001    0.39   127365   0.000012    3.99    12518
Females (20+ years/np/nn):
  0.000001    0.19   270255   0.000001    0.34   147665   0.000012    3.85    13003
```

Attachment 5: Terbufos Acute Probabilistic Dietary Exposure and Risk Analysis, Excluding Bananas.

Females (13-50 years):								
0.000001	0.22	224954	0.000001	0.36	137861	0.000012	4.00	12493
Males (13-19 years):								
0.000001	0.33	152440	0.000002	0.60	82864	0.000016	5.47	9141
Males (20+ years):								
0.000001	0.21	233668	0.000001	0.38	129986	0.000012	3.91	12787

Attachment 6: Terbufos Acute Probabilistic Dietary Exposure and Risk Analysis, Excluding Sweet Corn.

U.S. Environmental Protection Agency Ver. 6.78
DEEM Acute analysis for TERBUFOS 1989-92 data
Residue file name: C:\DRESSAC\105001sc.R96 Adjust. #2 NOT used
Analysis Date 08-18-1999 Residue file dated: 08-18-1999/12:44:58/8
Reference dose: aRfD = 0.0003 mg/kg bw/day NOEL = 0.15 mg/kg bw/day
Comment: UFs include 10X, 10X, 5X (acute only), and 1X for FQPA

RDF indices and file names for Monte Carlo Analysis
1 C:\Dressac\Nnftban.rdf

Food	Crop Grp	Food Name	RESIDUE (ppm)	RDF #	Adj.Factors #1	Adj.Factors #2	Code
72	O	Bananas	0.016000	1	1.000	1.000	
73	O	Bananas-dried	0.016000	1	3.900	1.000	
94	O	Plantains-ripe	0.016000	1	1.000	1.000	
112	O	Coffee	0.000280	0	1.000	1.000	
237	15	Corn/pop	0.000240	0	1.000	1.000	
266	15	Corn grain-endosperm	0.000240	0	1.000	1.000	
267	15	Corn grain-bran	0.000240	0	1.000	1.000	
268	15	Corn grain/sugar/hfcs	0.000240	0	1.500	1.000	
289	15	Corn grain-oil	0.000240	0	1.000	1.000	
378	O	Bananas-juice	0.016000	1	1.000	1.000	
388	15	Corn grain/sugar-molasses	0.000240	0	1.500	1.000	
481	O	Plantains-dried	0.016000	1	3.900	1.000	

Summary of Residue Distribution Files (RDF) listed in C:\DRESSAC\105001sc.R96

RDF #	File Name	N residues w freq's	N residues w/o freq's	N LODs	LOD Value	N Zeros
1	Nnftban.rdf	54	0	0	0	9231

Attachment 6: Terbufos Acute Probabilistic Dietary Exposure and Risk Analysis, Excluding Sweet Corn.

U.S. Environmental Protection Agency Ver. 6.78
DEEM ACUTE analysis for TERBUFOS (1989-92 data)
Residue file: 105001sc.R96 Adjustment factor #2 NOT used.
Analysis Date: 08-18-1999/17:02:42 Residue file dated: 08-18-1999/12:44:58/8
Acute Reference Dose (aRfD) = 0.000300 mg/kg body-wt/day
NOEL (Acute) = 0.150000 mg/kg body-wt/day
MC iterations = 1000 MC list in residue file MC seed = 1026
Run Comment: UFs include 10X, 10X, 5X (acute only), and 1X for FQPA

Summary calculations:

	95th Percentile			99th Percentile			99.9th Percentile		
	Exposure	% aRfD	MOE	Exposure	% aRfD	MOE	Exposure	% aRfD	MOE
U.S. pop - all seasons:	0.000002	0.56	88800	0.000016	5.40	9264	0.000063	21.08	2371
All infants (<1 year):	0.000013	4.23	11828	0.000081	27.10	1844	0.000254	84.58	591
Nursing infants (<1 year):	0.000001	0.32	156883	0.000043	14.42	3466	0.000128	42.82	1167
Non-nursing infants (<1 yr):	0.000016	5.46	9157	0.000084	28.09	1779	0.000260	86.64	577
Children (1-6 years):	0.000003	1.05	47403	0.000045	14.96	3343	0.000133	44.36	1127
Children (7-12 years):	0.000002	0.57	88257	0.000021	6.90	7247	0.000063	21.07	2373
Females (13-19 yrs/np/nn):	0.000001	0.32	156712	0.000010	3.39	14747	0.000032	10.71	4667
Females (20+ years/np/nn):	0.000001	0.33	151379	0.000012	4.13	12092	0.000034	11.43	4374
Females (13-50 years):	0.000001	0.29	173650	0.000011	3.65	13703	0.000033	11.08	

Attachment 6: Terbufos Acute Probabilistic Dietary Exposure and Risk Analysis, Excluding Sweet Corn.

4511
Males (13-19 years):
0.000001 0.43 115781 0.000013 4.21 11863 0.000041 13.74
3640
Males (20+ years):
0.000001 0.31 163432 0.000010 3.23 15489 0.000028 9.20
5433

Attachment 7: Terbufos Acute Probabilistic Dietary Exposure and Risk Analysis, Excluding Field Corn.

```
U.S. Environmental Protection Agency                                    Ver. 6.78
DEEM Acute analysis for TERBUFOS                                      1989-92 data
Residue file name: C:\DRESSAC\105001fc.R96                 Adjust. #2 NOT used
Analysis Date 08-20-1999            Residue file dated: 08-18-1999/12:45:33/8
Reference dose: aRfD = 0.0003 mg/kg bw/day  NOEL = 0.15 mg/kg bw/day
Comment: UFs include 10X, 10X, 5X (acute only), and 1X for FQPA. Excludes
field corn from the analysis
-------------------------------------------------------------------------
--
RDF indices and file names for Monte Carlo Analysis
 1  C:\Dressac\Nnftban.rdf
 2  C:\Dressac\Swtcorn.rdf
Food Crop                                  RESIDUE    RDF  Adj.FactorsCode
      Grp  Food Name                        (ppm)      #    #1     #2
---- ---- ------------------------------  ----------  --- ------ ------
  72 O    Bananas                          0.016000    1  1.000  1.000
  73 O    Bananas-dried                    0.016000    1  3.900  1.000
  94 O    Plantains-ripe                   0.016000    1  1.000  1.000
 112 O    Coffee                           0.000280    0  1.000  1.000
 238 15   Corn/sweet                       0.025000    2  1.000  1.000
 378 O    Bananas-juice                    0.016000    1  1.000  1.000
 481 O    Plantains-dried                  0.016000    1  3.900  1.000

   Summary of Residue Distribution Files (RDF) listed in
C:\DRESSAC\105001fc.R96
 RDF      File        N residues   N residues   N LODs      LOD       N Zeros
  #       Name         w freq's    w/o freq's              Value
 ----  ------------   ----------   ----------   ------   ----------   -------
  1    Nnftban.rdf       54          0            0        0             9231
  2    Swtcorn.rdf       0           14           0        0              233

U.S. Environmental Protection Agency                                    Ver. 6.78
DEEM ACUTE analysis for TERBUFOS                                 (1989-92 data)
Residue file: 105001fc.R96                      Adjustment factor #2 NOT
used.
Analysis Date: 08-20-1999/10:45:19    Residue file dated:
08-18-1999/12:45:33/8
Acute Reference Dose (aRfD) =   0.000300 mg/kg body-wt/day
NOEL (Acute) =   0.150000 mg/kg body-wt/day
MC iterations = 1000     MC list in residue file     MC seed =  1026
Run Comment: UFs include 10X, 10X, 5X (acute only), and 1X for FQPA. Excludes
field corn from the analysis
=========================================================================
=
Summary calculations:
      95th Percentile            99th Percentile            99.9th
Percentile
```

Attachment 7: Terbufos Acute Probabilistic Dietary Exposure and Risk Analysis, Excluding Field Corn.

Exposure	% aRfD	MOE	Exposure	% aRfD	MOE	Exposure	% aRfD	MOE
U.S. pop - all seasons:								
0.000002	0.54	92426	0.000019	6.30	7931	0.000070	23.40	2136
All infants (<1 year):								
0.000009	2.93	17037	0.000084	27.90	1792	0.000253	84.17	594
Nursing infants (<1 year):								
0.000000	0.00	>1000000	0.000041	13.54	3691	0.000125	41.83	1195
Non-nursing infants (<1 yr):								
0.000018	5.86	8528	0.000086	28.64	1745	0.000260	86.76	576
Children (1-6 years):								
0.000008	2.72	18386	0.000049	16.34	3059	0.000141	47.01	1063
Children (7-12 years):								
0.000002	0.81	61435	0.000024	7.87	6349	0.000069	22.97	2176
Females (13-19 yrs/np/nn):								
0.000000	0.01	>1000000	0.000011	3.72	13455	0.000036	12.08	4139
Females (20+ years/np/nn):								
0.000003	0.96	52040	0.000015	5.06	9887	0.000037	12.27	4074
Females (13-50 years):								
0.000001	0.20	255285	0.000013	4.42	11322	0.000036	12.15	4115
Males (13-19 years):								
0.000000	0.06	810077	0.000015	5.13	9745	0.000050	16.77	2981
Males (20+ years):								
0.000002	0.72	69399	0.000012	4.13	12098	0.000032	10.60	4717